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EXAMINER	
GERSTL, SHANE F	

ART UNIT	PAPER NUMBER
2183	

DATE MAILED: 03/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/751,747	HUDEPOHL ET AL.	
	Examiner	Art Unit	
	Shane F Gerstl	2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-23 have been examined.

Papers Received

2. Receipt is acknowledged of information disclosure statement and amendment papers submitted, where the papers have been placed of record in the file.

3. The amendment has overcome the claim objection, which is herein withdrawn.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Claim 1 recites the limitation "said order" in line 16. There is insufficient antecedent basis for this limitation in the claim. It is unclear which of the plurality of orders is being referred to. The examiner taking the claim to mean "said data order" based on the specification.

Claim Rejections - 35 USC § 101

7. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. Claims 10-21 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Applicant's claims 10-21 attempt to claim computer data signals. Computer data signals are not patentable because they do not fall within one of the statutory classes of subject matter allowed by 35 USC § 101. Claim 10 recites the use of a computer usable medium. Page 60 of the specification gives examples of a computer usable medium and a computer usable transmission medium. The term "computer usable medium" encompasses the term "computer usable transmission medium", which is shown in the examples to embody such things as a carrier wave and a computer data signal. Claim 14 explicitly claims a computer data signal embodied on a transmission medium.

To define what is meant by a signal one must begin with basic concepts of the physical world. As explained in Gillespie et al., Chemistry 2 (Allyn and Bacon, Inc. 1986):

> "We can describe the universe, and all the changes occurring in it, in terms of two fundamental concepts: matter and energy. Matter is anything that occupies space and has mass. Water, air, rocks, and petroleum, for example, are matter, but heat and light are not; they are forms of energy. The many different kinds of matter are known as substances. ..."

When referring to "structure" or "material" or "substance" what is being referred to is matter and things made up of matter. Energy is further defined at Chemistry 53:

"The capacity to do work is called energy. Gasoline, for example, possesses energy because when it is burned, it can do the work of moving a car. We measure energy by the work done, and thus energy, like work, is measured in joules.

In practice, it is convenient to distinguish different forms of energy, such as heat energy, light energy, electric energy, and chemical energy. ..."

Energy has physical existence because it is capable of doing work and of being measured, but is incorporeal.

The claimed computer data signal, like an electromagnetic signal, is a form of electric energy which has physical existence as an electromagnetic wave in a communications path or as an electrical voltage in the circuits of a transmitter or receiver. This is distinguished from the use of the term signal to refer to an abstract quantity such as a number. See In re Walter, 618 F.2d 758, 770, 205 USPQ 397, 409 (CCPA 1980) ("The 'signals' processed by the inventions of claims 10-12 may represent either physical quantities or abstract quantities; the claims do not require one or the other").

The starting point for nonstatutory subject matter analysis is the statute, 35 USC § 101, and the Supreme Court's basic principles as enunciated in Diamond v. Diehr, 450 U.S. 175 (1981). As stated in In re Warmerdam, 33 F.3d 1354, 1358, 31 USPQ2d 1754, 1758 (Fed. Cir. 1994):

"Despite the oft-quoted statement in the legislative history of the 1952 Patent Act

that Congress intended that statutory subject matter "include anything under the sun that is made by man," S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952), reprinted in 1952 U.S.C.C.A.N. 2394, 2399; H.R. Rep. No. 1923, 82d Cong., 2d Sess., 6 (1952), Congress did not so mandate. Congress included in patentable subject matter only those things that qualify as "any . . . process, machine, manufacture, or composition of matter, or any ... improvement thereof. ..." 35 U.S.C. § 101. ...

To include some things is to exclude others. The chore of defining exactly what is excluded under § 101, and applying such definitions to specific cases, has caused courts to expend much effort in trying to find the right words to describe some rather abstract notions. In Diamond v. Diehr, 450 U.S. 175 (1981), the Supreme Court summarized the scope of the § 101 exclusion and the Court's prior efforts at describing it by saying "[e]xcluded from such patent protection are laws of nature, natural phenomena, and abstract ideas. ... Our recent holdings in Gottschalk v. Benson and Parker v. Flook, both of which are computer-related, stand for no more than these long-established principles." Id. at 185.

Two comments are relevant. First, subject matter must first fall within § 101 before the exclusions apply. See In re Pardo, 684 F.2d 912, 916, 214 USPQ 673, 677 (CCPA 1982) ("[A]ny process, machine, manufacture, or composition of matter constitutes statutory subject matter unless it falls within a judicially determined

exception to section 101."); In re Sarkar, 588 F.2d 1330, 1333, 200 USPQ 132, 137 (CCPA 1978) ("[A] series of steps is a 'process' within § 101 unless it falls within a judicially determined category of nonstatutory subject matter exceptions."). Second, it is not certain that "laws of nature, natural phenomena, and abstract ideas" represent an exhaustive set of statutory subject matter exclusions, such that "laws of nature, natural phenomena, and abstract ideas" combined with the set of "process, machine, manufacture, or composition of matter" comprises a universal set all possible types of subject matter. Thus, subject matter is not presumed to be statutory under 35 U.S.C. § 101 if it does not fit within the enumerated exclusions of "laws of nature, natural phenomena, and abstract ideas." The proper analysis is to determine whether the claimed subject matter falls within one of the four classes of § 101 and, if so, whether the subject matter falls within one of the exclusions.

First the claimed signal is analyzed under the definitions of the four statutory classes of § 101. The claimed signal is clearly not a "process" under § 101 because it is not a series of steps. The other three § 101 classes of machine, compositions of matter and manufactures "relate to structural entities and can be grouped as 'product' claims in order to contrast them with process claims." D. Chisum, Patents § 1.02 (1994). The three product classes have traditionally required physical structure or material (matter).

"The term machine includes every mechanical device or combination of mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result." Corning v. Burden, 56 U.S. (15 How.)

252, 267 (1854). A modern definition of machine would no doubt include electronic devices which perform functions. Indeed, devices such as flip-flops and computers are referred to in computer science as sequential machines. The claimed signal has no physical structure, does not itself perform any useful, concrete and tangible result and, thus, does not fit within the definition of a machine.

A "composition of matter" "covers all compositions of two or more substances and includes all composite articles, whether they be results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids." Shell Development Co. v. Watson, 149 F. Supp. 279, 280, 113 USPQ 265, 266 (D.D.C. 1957), aff'd, 252 F.2d 861, 116 USPQ 428 (D.C. Cir. 1958). The claimed signal is not matter, but a form of energy, and therefore is not a composition of matter.

The Supreme Court has read the term "manufacture" in accordance with its dictionary definition to mean "the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery." Diamond v. Chakrabarty, 447 U.S. 303, 308, 206 USPQ 193, 196-97 (1980) (quoting American Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1, 11, 8 USPQ 131, 133 (1931), which, in turn, quotes the Century Dictionary). Other courts have applied similar definitions. See American Disappearing Bed Co. v. Arnaelsteen, 182 F. 324, 325 (9th Cir. 1910), cert. denied, 220 U.S. 622 (1911). These definitions require physical substance, which the claimed signal does not have. Congress can be presumed to be aware of an administrative or judicial interpretation of a statute and to adopt that interpretation when it re-enacts a statute without change.

Lorillard v. Pons, 434 U.S. 575, 580 (1978). Thus, Congress must be presumed to have been aware of the interpretation of manufacture in American Fruit Growers when it passed the 1952 Patent Act.

A manufacture is also defined as the residual class of product. Chisum, § 1.02[3] (citing W. Robinson, The Law of Patents for Useful Inventions 270 (1890)). A product is a tangible physical article or object, some form of matter, which the claimed signal is not. That the other two product classes, machine and composition of matter, require physical matter is evidence that a manufacture was also intended to require physical matter. The claimed signal, a form of energy, does not fall within either of the two definitions of manufacture.

Continuing to look at the § 101 class of manufacture, in In re Hruby, 373 F.2d 997, 153 USPQ 61 (CCPA 1967), the CCPA held that there was no distinction between the meaning of "manufacture" in § 101 and "article of manufacture" in § 171 for designs. The issue in Hruby was whether that portion of a water fountain which is composed entirely of water in motion was an article of manufacture. The CCPA relied on the analysis of the term manufacture in Riter-Conley Mfg. Co. v. Aiken, 203 F. 699 (3d Cir.), cert. denied, 229 U.S. 617 (1913), a case involving a utility patent. The CCPA stated in Hruby, 373 F.2d at 1000, 153 USPQ at 65:

> "The gist of it is, as one can determine from dictionaries, that a manufacture is anything made "by the hands of man" from raw materials, whether literally by hand or by machinery or by art."

The CCPA held that the fountain was made of the only substance fountains can be made of --water-- and determined that designs for water fountains were statutory. Articles of manufacture in designs manifestly require physical matter to provide substance for embodiment of the design. Thus, since "article of manufacture" under § 171 has the same meaning as "manufacture" under § 101, it is inevitable that a manufacture under § 101 requires physical matter.

Some indirect evidence that Congress intended to limit patentable subject matter to physical things and steps is found in 35 USC § 112 paragraph 6. Paragraph 6 states that an element in a claim for a combination may be expressed as a "means or step" for performing a function and will be construed to cover the corresponding "structure, material, or acts described in the specification and equivalents thereof." "Structure" and "material" indicate tangible things made of matter, not energy.

The claimed signal does not fit clearly within one of the three Diehr exclusions of "laws of nature, natural phenomena or abstract ideas." A signal may be an abstraction because it is disembodied in the sense of having no physical structure. Even if the signal were a signal in a wire, which requires movement of physical matter such as electrons, the signal is the propagating disturbance in the medium, not the medium itself. In any case, however, the exclusions are not controlling because subject matter must first fall within § 101 before the exclusions apply. Pardo and Sarkar, supra.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1-8 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moyer (5,983,338) in view of Strongin (6,559,850 B1).

11. In regard to claim 1,

a. Moyer has disclosed an interface (figure 1, element 30) for transferring data between a central processing unit (CPU) (figure 1, element 12) and a plurality of coprocessors (figure 1, elements 14 and 16), the interface comprising:

i. an instruction bus (column 6, line 34 and figures 2 and 3, element 61), configured to transfer instructions to the plurality of coprocessors in an instruction transfer order (an order is inherent), wherein particular instructions direct one of the plurality of coprocessors to transfer the data to/from the CPU (figures 22-26, UU field); and

ii. a data bus (column 8, lines 65-66 and figures 2 and 3, element 72), coupled to said instruction bus (since both go from processor to coprocessor, they are coupled), configured to transfer the data.

b. Moyer does not disclose wherein data order signals within said data bus specify a data transfer order that differs from said instruction transfer order, and wherein said data order signals specify transfer of a data element corresponding to a specific outstanding instruction that is relative in order to all outstanding

instructions, said outstanding instructions being those of said particular instructions transferred to said one of the plurality of coprocessors that have not completed a data transfer; wherein the interface keeps track of an order of said outstanding instructions, and wherein said data order signals indicate said order, and wherein said data order signals are provided with said data element as said data element is transferred.

c. Strongin has disclosed in figures 3 and 4 a read retrieval order that differs from the read request order. An instruction as in Moyer is essentially a request for data or a read request. When the data is sent, that is a read retrieval. The figure shows signals (identifier) that indicate the order of the data. Figure 6 of Strongin shows that the identifiers or data order signals sent back with the data give *an order* as called for by the claims and show that any of a specific outstanding instruction is relative in order (which is inherent) to all the outstanding instructions.

d. Strongin has shown in column 6, lines 36-44 that this difference in ordering allows for data accesses to be quicker. This quickness of data access would have motivated one of ordinary skill in the art to modify the design of Moyer to include the out of order data retrieval disclosed by Strongin. With this modification in place, the data order signals would specify transfer of a data element corresponding to a specific outstanding instruction that is relative in order to all outstanding instructions. Since the disclosure of Moyer is dealing with the transfer of data between a processor and coprocessors, the data is

inherently associated with outstanding instructions and further it is inherent that the instruction is relative to all other instructions in some manner. This relation could simply be instruction order, which would then mean that the outstanding instruction is relative to the other instructions in that some are before it and some after in program order.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Moyer to retrieve data out of order as taught by Strongin so that data accesses can be achieved quicker.

12. In regard to claim 2,

a. Moyer in view of Strongin discloses the interface as recited in claim 1, as described above;

b. Moyer in view of Strongin does not disclose specifically that the plurality of coprocessors comprises: a first plurality of floating-point coprocessors;

c. Moyer has shown in column 1, lines 31-37 that a traditional use of coprocessors is as floating-point coprocessors.

d. The ability to extend the functionality of the processor disclosed by Moyer by including floating point processing would have motivated one of ordinary skill in the art to modify the coprocessor design of Moyer in view of Strongin to making them floating-point processors.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Moyer in view of Strongin to make the disclosed coprocessors floating-point coprocessors in order to extend the functionality of the main processor.

13. In regard to claim 3, Moyer in view of Strongin discloses the interface as recited in claim 1, as described above, wherein said particular instructions comprise TO instructions, said TO instructions directing that the subsequent transfer of the data will be from the CPU to said designated ones of the plurality of coprocessors. Column 9, lines 27-28 of Moyer, show an H_CALL instruction that transfers data from an external coprocessor to the processor as shown in lines 40-45.

14. In regard to claim 4, Moyer in view of Strongin discloses the interface as recited in claim 3, as described above, wherein said particular instructions comprise FROM instructions, said FROM instructions directing that the subsequent transfer of the data will be from the CPU to said designated ones of the plurality of coprocessors. [Column 9, lines 27-39 of Moyer, show an H_CALL instruction that transfers data to an external coprocessor from the processor.]

15. In regard to claim 5, Moyer in view of Strongin discloses the interface as recited in claim 4, as described above, wherein said data bus comprises:

a. data TO signals, for transferring data from the CPU to said designated ones of the plurality of coprocessors (Moyer, column 9, lines 20-25);

b. data FROM signals, for transferring data to the CPU from said designated ones of the plurality of coprocessors (Moyer, column 9, lines 25-27).

16. In regard to claim 6, Moyer in view of Strongin discloses the interface as recited in claim 5, as described above, wherein said data order signals comprise:

a. TO order signals, for prescribing said data transfer order with respect to transfers via said data TO signals; and

b. FROM order signals, for prescribing said data transfer order with respect to transfers via said data FROM signals.

[Since the order signals specify data order for all data accesses the data order is specifyd for data going to and from the coprocessors. Thus the signals can be called TO and FROM order signals respective to the coprocessors.]

17. In regard to claim 7, Moyer in view of Strongin discloses the interface as recited in claim 6, as described above, wherein said TO order signals specify a particular outstanding TO instruction relative to all outstanding TO instructions. [Figure 4 and column 10, lines 46-61 of Strongin, show that the order signals (identifiers) give indication of which instruction (read request) the data corresponds to. This instruction is relative to the other outstanding (pending) instructions. For example instruction (read request) 100N follows instruction 1001 and is thus relative to it.]

18. In regard to claim 8, Moyer in view of Strongin discloses the interface as recited in claim 6, as described above, wherein said FROM order signals specify a particular outstanding FROM instruction relative to all outstanding FROM instructions. [Figure 4 and column 10, lines 46-61 of Strongin, show that the order signals (identifiers) give indication of which instruction (read request) the data corresponds to. This instruction is relative to the other outstanding (pending) instructions. For example instruction (read request) 100N follows instruction 1001 and is thus relative to it.]

19. In regard to claim 22,

a. Moyer has disclosed a method for transferring data (via figure 1, element 30) between a CPU (figure 1, element 12) and a plurality of coprocessors (figure 1, elements 14 and 16), the method comprising:

i. transmitting instructions to one of the plurality of coprocessors (column 6, lines 34-36), each of the instructions directing a data transfer between the CPU and the one of the plurality of coprocessors (figures 22-26, UU field), wherein said transmitting is provided in a specific instruction order (an order is inherent);

b. Moyer does not disclose transferring the data in an order different from the specific instruction order, prescribing transfer of a data element corresponding to a specific outstanding instruction that is relative in order to all outstanding instructions, the outstanding instructions being those of the instructions transmitted to one of the plurality of coprocessors that have not completed a data transfer and providing the data order signals with the data element as the data element is transferred.

c. Strongin has disclosed in figures 3 and 4 a read retrieval order that differs from the read request order. An instruction as in Moyer is essentially a request for data or a read request. When the data is sent, that is a read retrieval. The figure shows signals (identifier) that indicate the order of the data. Figure 6 of Strongin shows that the identifiers or data order signals sent back with the data give *an order* as called for by the claims and show that any of a specific outstanding instruction is relative in order (which is inherent) to all the

outstanding instructions. Figure 4 and column 10, lines 46-61 of Strongin, show that the order signals (identifiers) give indication of which instruction (read request) the data corresponds to. This instruction is relative to the other outstanding (pending) instructions. For example instruction (read request) 100N follows instruction 1001 and is thus relative to it.

d. Strongin has shown in column 6, lines 36-44 that this difference in ordering allows for data accesses to be quicker. This quickness of data access would have motivated one of ordinary skill in the art to modify the design of Moyer to include the out of order data retrieval disclosed by Strongin.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Moyer to retrieve data out of order as taught by Strongin so that data accesses can be achieved quicker.

20. Claims 9 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moyer in view of Strongin as applied to claims 1-8 and 22 above, and further in view of Hennessy.

21. In regard to claim 9,

a. Moyer in view of Strongin discloses the interface as recited in claim 1, as described above,

b. Moyer in view of Strongin does not disclose wherein said data bus transfers the data in parallel to one of said designated ones of the plurality of coprocessors, said one of said designated ones of the plurality of coprocessors having multiple issue pipelines providing for parallel instruction execution.

c. Hennessy has shown on pages 282-284 a multiple instruction issue technique. This inherently involves multiple data elements and thus the data bus to such a processor transfers data in parallel.

d. Hennessy has shown on page 278 that multiple-issue processors allow multiple instructions to issue each clock cycle. It is further shown that this decreases CPI below one and increases performance. This performance boost would have motivated one of ordinary skill in the art to modify the design of Moyer in view of Strongin to use the multiple issue technique described by Hennessy for its coprocessors.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the coprocessors and data bus of Moyer in view of Strongin to include the multiple instruction issue technique taught by Moyer in view of Strongin in order to increase performance of the overall system.

22. In regard to claim 23,

a. Moyer in view of Strongin discloses the method as recited in claim 22, as described above, said transmitting comprises:

b. Moyer in view of Strongin does not disclose

i. issuing a plurality of the instructions in parallel to the specific coprocessor;

ii. designating an execution order corresponding to said issuing.

c. Hennessy has shown on pages 282-284 a multiple instruction issue technique. This inherently involves multiple instructions and thus the bus to such a processor transfers instructions in parallel.

d. Hennessy has shown on page 278 that multiple-issue processors allow multiple instructions to issue each clock cycle. It is further shown that this decreases CPI below one and increases performance. This performance boost would have motivated one of ordinary skill in the art to modify the design of Moyer in view of Strongin to use the multiple issue technique described by Hennessy for its coprocessors.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the coprocessors and data bus of Moyer in view of Strongin to include the multiple instruction issue technique taught by Moyer in view of Strongin in order to increase performance of the overall system.

23. Claims 10-12 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moyer in view of Tanenbaum and further in view of Strongin.

24. In regard to claim 10,

a. Moyer discloses a computer program product for use with a computing device, the computer program product comprising:

i. a computer usable medium, for causing a coprocessor interface to be described that transfers data between CPU and a plurality of coprocessors, said computer readable program code comprising:

(1) an instruction bus, said instruction bus configured to transfer instructions to said plurality of coprocessors in an instruction transfer order, wherein particular instructions direct designated ones of the plurality of coprocessors to transfer said data to/from said CPU; and

(2) a data bus, said data bus configured to subsequently transfer said data.

b. Moyer does not disclose having computer readable program code embodied in said medium and first program code and second program code. Moyer also does not disclose wherein data order signals within said data bus specify a data transfer order that differs from said instruction transfer order and wherein said data order signals specify transfer of a data element corresponding to a specific outstanding instruction relative to all outstanding instructions, said outstanding instructions being those of said particular instructions transferred to said one of the plurality of coprocessors that have not completed a data transfer; wherein the interface keeps track of an order of said outstanding instructions, and wherein said data order signals indicate said order, and wherein said data order signals are provided with said data element as said data element is transferred.

c. Tanenbaum has disclosed on pages 10-12 that hardware is logically equivalent to software and that the boundaries between them are fluid. Strongin has disclosed in figures 3 and 4 a read retrieval order that differs from the read

request order. An instruction as in Moyer is essentially a request for data or a read request. When the data is sent, that is a read retrieval. The figure shows signals (identifier) that indicate the order of the data. Figure 6 of Strongin shows that the identifiers or data order signals sent back with the data give *an order* as called for by the claims and show that any of a specific outstanding instruction is relative in order (which is inherent) to all the outstanding instructions.

d. Tanenbaum has shown on page 11 that for one factor involved in deciding whether to implement a function in hardware or software is frequency of change. It is easier to change software code than to change the layout of a hardware system. This ease of change would have motivated one of ordinary skill in the art to modify the design of Moyer to implement the disclosed apparatus as program code as taught by Tanenbaum. Strongin has shown in column 6, lines 36-44 that this difference in ordering allows for data accesses to be quicker. This quickness of data access would have motivated one of ordinary skill in the art to modify the design of Moyer to include the out of order data retrieval disclosed by Strongin. With this modification in place, the data order signals would specify transfer of a data element corresponding to a specific outstanding instruction relative to all outstanding instructions. Since the disclosure of Moyer is dealing with the transfer of data between a processor and coprocessors, the data is inherently associated with outstanding instructions and further it is inherent that the instruction is relative to all other instructions in some manner. This relation could simply be instruction order, which would then mean that the outstanding

instruction is relative to the other instructions in that some are before it and some after in program order.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Moyer to implement his design in program code as taught by Tanenbaum and to retrieve data out of order as taught by Strongin so that data accesses can be achieved quicker and so that changes may be made easier.

25. In regard to claim 11, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer program product as recited in claim 10, as described above, wherein said particular instructions comprise:

a. TO instructions, said TO instructions directing that the subsequent transfer of said data will be from said CPU to said designated ones of said plurality of coprocessors; [Column 9, lines 27-28 of Moyer, show an H_CALL instruction that transfers data from an external coprocessor to the processor as shown in lines 40-45.]

b. FROM instructions, said FROM instructions directing that the subsequent transfer of said data will be to said CPU from said designated ones of said plurality of coprocessors. [Column 9, lines 27-39 of Moyer, show an H_CALL instruction that transfers data to an external coprocessor from the processor.]

26. In regard to claim 12, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer program product: as recited in claim 11, as described above, wherein said data order signals comprise:

a. TO order signals, for specifying said data transfer order for a particular outstanding TO instruction relative to all outstanding TO instructions;

b. FROM order signals, for specifying said data transfer order for a particular outstanding FROM instruction relative to all outstanding FROM instructions.

[Since the order signals specify data order for all data accesses the data order is specifyd for data going to and from the coprocessors. Thus the signals can be called TO and FROM order signals respective to the coprocessors.]

27. In regard to claim 14,

a. Moyer discloses a computer data signal embodied in a transmission medium, the computer data signal comprising:

i. an instruction bus, said instruction bus configured to transfer instructions to said plurality of coprocessors in an instruction transfer order, wherein particular instructions direct designated ones of the plurality of coprocessors to transfer said data to/from said CPU; and

ii. a data bus, said data bus configured to subsequently transfer said data.

b. Moyer does not disclose having computer-readable program code for providing the above. Moyer also does not disclose wherein data order signals within said data bus specify a data transfer order that differs from said instruction transfer order and said outstanding instructions being those of said particular instructions transferred to said one of the plurality of coprocessors that have not completed a data transfer; wherein the interface keeps track of an order of said

outstanding instructions, and wherein said data order signals indicate said order, and wherein said data order signals are provided with said data element as said data element is transferred...

c. Tanenbaum has disclosed on pages 10-12 that hardware is logically equivalent to software and that the boundaries between them are fluid. Strongin has disclosed in figures 3 and 4 a read retrieval order that differs from the read request order. An instruction as in Moyer is essentially a request for data or a read request. When the data is sent, that is a read retrieval. The figure shows signals (identifier) that indicate the order of the data. Figure 6 of Strongin shows that the identifiers or data order signals sent back with the data give *an order* as called for by the claims and show that any of a specific outstanding instruction is relative in order (which is inherent) to all the outstanding instructions.

d. Tanenbaum has shown on page 11 that for one factor involved in deciding whether to implement a function in hardware or software is frequency of change. It is easier to change software code than to change the layout of a hardware system. This ease of change would have motivated one of ordinary skill in the art to modify the design of Moyer to implement the disclosed apparatus as program code as taught by Tanenbaum. Strongin has shown in column 6, lines 36-44 that this difference in ordering allows for data accesses to be quicker. This quickness of data access would have motivated one of ordinary skill in the art to modify the design of Moyer to include the out of order data retrieval disclosed by Strongin.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Moyer to implement his design in program code as taught by Tanenbaum and to retrieve data out of order as taught by Strongin so that data accesses can be achieved quicker and so that changes may be made easier.

28. In regard to claim 15, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer data signal as recited in claim 14, as described above, wherein said particular instructions comprise TO instructions, said TO instructions directing that subsequent transfer of said data will be from said CPU to said particular coprocessors. [Column 9, lines 27-28 of Moyer, show an H_CALL instruction that transfers data from an external coprocessor to the processor as shown in lines 40-45.]

29. In regard to claim 16, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer data signal as recited in claim 15, as described above, wherein said particular instructions comprise TO instructions, said TO instructions directing that subsequent transfer of said data will be from said CPU to said particular coprocessors. [Column 9, lines 27-39 of Moyer, show an H_CALL instruction that transfers data to an external coprocessor from the processor.]

30. In regard to claim 17, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer data signal as recited in claim 14, wherein said data bus comprises:

a. data TO signals, for transferring data from said CPU to said particular coprocessors (Moyer, column 9, lines 20-25);; and

b. data FROM signals, for transferring data to said CPU from said particular coprocessors (Moyer, column 9, lines 25-27).

31. In regard to claim 18, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer data signal as recited in claim 17, wherein said data order signals comprise:

a. TO order signals, for prescribing said data transfer order with respect to transfers via said data TO signals; and

b. FROM order signals, for prescribing said data transfer order with respect to transfers via said data FROM signals.

[Since the order signals specify data order for all data accesses the data order is specifyd for data going to and from the coprocessors. Thus the signals can be called TO and FROM order signals respective to the coprocessors.]

32. In regard to claim 19, Moyer in view of Tanenbaum and further in view of Strongin the computer data signal as recited in claim 18, wherein said TO order signals specify a particular outstanding TO instruction relative to all outstanding TO instructions. [Figure 4 and column 10, lines 46-61 of Strongin, show that the order signals (identifiers) give indication of which instruction (read request) the data corresponds to. This instruction is relative to the other outstanding (pending) instructions. For example instruction (read request) 100N follows instruction 1001 and is thus relative to it.]

33. In regard to claim 20, Moyer in view of Tanenbaum and further in view of Strongin discloses the computer data signal as recited in claim 18, wherein said FROM order signals specify a particular outstanding FROM instruction relative to all

outstanding FROM instructions. [Figure 4 and column 10, lines 46-61 of Strongin, show that the order signals (identifiers) give indication of which instruction (read request) the data corresponds to. This instruction is relative to the other outstanding (pending) instructions. For example instruction (read request) 100N follows instruction 1001 and is thus relative to it.]

34. Claims 13 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moyer in view of Tanenbaum and further in view of Strongin as applied to claims 10-12 above, and further in view of Hennessy.

35. In regard to claim 13,

a. Moyer in view of Tanenbaum and further in view of Strongin discloses the computer program product as recited in claim 10, as described above,

b. Moyer in view of Tanenbaum and further in view of Strongin does not disclose wherein said data bus is configured to transfer said data in parallel to particular coprocessors that have multiple issue pipelines providing for parallel instruction execution and corresponding data transfers.

c. Hennessy has shown on pages 282-284 a multiple instruction issue technique. This inherently involves multiple data elements and thus the data bus to such a processor transfers data in parallel.

d. Hennessy has shown on page 278 that multiple-issue processors allow multiple instructions to issue each clock cycle. It is further shown that this decreases CPI below one and increases performance. This performance boost would have motivated one of ordinary skill in the art to modify the design of

Moyer in view of Strongin to use the multiple issue technique described by Hennessy for its coprocessors.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the coprocessors and data bus of Moyer in view of Strongin to include the multiple instruction issue technique taught by Moyer in view of Strongin in order to increase performance of the overall system.

36. In regard to claim 21,

a. Moyer in view of Tanenbaum and further in view of Strongin discloses the computer program product as recited in claim 14, as described above,

b. Moyer in view of Tanenbaum and further in view of Strongin does not disclose wherein said data bus is configured to transfer said data in parallel to particular coprocessors that have multiple issue pipelines providing for parallel instruction execution and corresponding data transfers.

c. Hennessy has shown on pages 282-284 a multiple instruction issue technique. This inherently involves multiple data elements and thus the data bus to such a processor transfers data in parallel.

d. Hennessy has shown on page 278 that multiple-issue processors allow multiple instructions to issue each clock cycle. It is further shown that this decreases CPI below one and increases performance. This performance boost would have motivated one of ordinary skill in the art to modify the design of Moyer in view of Strongin to use the multiple issue technique described by Hennessy for its coprocessors.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the coprocessors and data bus of Moyer in view of Strongin to include the multiple instruction issue technique taught by Moyer in view of Strongin in order to increase performance of the overall system.

Response to Arguments

37. Applicant's arguments filed 2/22/05 have been fully considered but they are not persuasive.

38. Applicant has argued with regard to the independent claims that Strongin's transaction Ids do not indicate a transfer that is relative in order to all outstanding instructions, but gives an absolute order upon transfer of the data that indicates the ordering of transactions per previously issued requests. The examiner would like to point out that the above argument is not what is claimed. The claims specify transfer of a data element corresponding to a specific outstanding **instruction** that is relative in order to all outstanding instructions, not that the order is relative to the outstanding instructions. That said, figure 6 shows that the identifiers or data order signals sent back with the data give *an order* as called for by the claims and show that any of a specific outstanding instruction is relative in order (which is inherent) to all the outstanding instructions.

Conclusion

39. The following is text cited from 37 CFR 1.111(c): In amending in reply to a rejection of claims in an application or patent under reexamination, the applicant or patent owner must clearly point out the patentable novelty which he or she thinks the

claims present in view of the state of the art disclosed by the references cited or the objections made. The applicant or patent owner must also show how the amendments avoid such references or objections.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shane F Gerstl whose telephone number is (571) 272-4166. The examiner can normally be reached on M-F 6:45-4:15 (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shane F Gerstl
Examiner
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SFG
March 18, 2005

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